occurring in tabes. It was said that melancholic symptoms were commoner in females, but he himself had met with them oftener in men. One general paralytic had tried to hang himself, but no general paralytic woman had attempted suicide in his experience. Female cases were often quietly weak-minded. He had had several cases of general paralysis in which the control of the bladder had been regained.

Some Clinical Notes upon Urine-Testing and Results.[1]

By ROBERT JONES, M.D.

THIS fragmentary paper is to suggest rather than to inform. It is a bedside analysis of the urine in 969 female patients consecutively admitted into Claybury Asylum, and the notes cover a period of several years. Although the facts are many, the deductions are few, and although possibly nothing new is related, yet these notes involve an extensive collection of common details, and there has been some labour undertaken to present them. The summary may, I venture to hope, serve as an incentive to others to contribute more detailed statistics upon an aspect of mental diseases which is at present much talked of and much written about, *viz.*, the relation of insanity to auto-intoxication and its dependence upon changed metabolism, particularly in an alteration through this changed metabolism of the normal functions of the kidneys, and I propose to run somewhat rapidly through the following headings. And first as to—

(1) *Quantity.*—The amount of urine secreted in each case during the twenty-four hours has not been noted, and therefore I will make no statement whether, as is asserted, there may be any greater amount of urine passed in cases of mania than in cases of the depressed form of insanity, attributed as it is to the relatively greater activity of the metabolic (or the katabolic) process believed to occur in this form.

(2) *Colour.*—Again, although no tint test has been used, the impression gained by the record is that the colour of the urine is darker in the insane upon their admission into the asylum, when the mental condition is somewhat acute, than it is in normal persons. It must be remembered, however, that the tint of the urine fluctuates widely, even in health, and that this depends not only upon the degree of dilution but also upon the

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reaction, an acid urine being darker than one which is alkaline, even when they are equally concentrated, and the relative proportion of acid urine to alkaline met with in the cases recorded has been almost as 50 to 1.

(3) *Reaction.*—The reaction taken with litmus paper showed 821, a proportion of 85 *per cent.*, to be acid, due, probably, to the acid phosphate of sodium (NaH_2PO_4) and not to the presence of a free acid; 123 cases, 13 *per cent.*, were neutral, and only 17, or 2 *per cent.*, alkaline. The patients were admitted after a journey and a considerable time after a meal, so that there was no "meal-tide" alkalinity. No quantitative estimation of acidity was made, nor is this said to be of any clinical value, for the intensity of the red colour produced in the litmus-paper is most often a sufficient indication of the degree of acidity.

(4) *Consistence.*—No special observations have been kept as to the consistence of the urine, but there have been variations, as may be inferred from the fact that in a small percentage of cases sugar, bile, mucus, pus (in one case of pyelo-nephritis), and other constituents have been present.

(5) *Odour.*—No notes have been kept under this head, but the urine in some cases has presented a high odour, probably due to the presence of aromatic sulphates, and possibly indicative of auto-intoxication through the absorption and retention of some of the intestinal contents. The presence of ethereal sulphates in the urine, owing to the combination of organic radicals—such as indol, skatol, phenol, etc.—with sulphuric acid has been investigated by many foreign workers, and Dr. Townsend recently contributed an interesting article (*Journal of Mental Science*, April, 1905), upon the presence of indoxyl in the urine of cases of melancholia. This constituent is an oxidised product of indol, a normal factor in the disintegration of albuminous substances. It is said to be absorbed into the blood, whence (uniting with potassium sulphate to form indoxyl) it is eliminated in the urine. There are several similar fatty acids formed by the breaking up of albuminous substances, but it is not ascertained whether their presence is the cause of the mental depression, or whether they are the consequence, and due, therefore, to impairment of nerve tone and power caused by the insanity which thus interferes with normal metabolism. At any rate, this substance has been taken as an index of the

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intestinal putrefaction and of the absorption of such products of disintegration into the blood.

The whole question of the katabolism of protein has recently been worked out by Otto Folin (*American Journal of Psychology*, February and March, 1905), to whose contributions reference may be made. In regard to the poisonous effects of human urine upon the lower animals, experiments carried out as to its toxicity have not yielded much result. It is even stated that normal urine contains more toxins than that of insane persons, and no conclusion as to the mental state of the patient can be arrived at from experiments of the kind referred to.

(6) *Density.*—This, as ascertained by the urinometer, has been investigated in 963 cases, and the specific gravity thus ascertained is recorded in the following table:

Specific Gravity.		
1000 to 1009	5	cases.
1010 to 1019	364	„
1020 to 1029	420	„
1030 to 1039	159	„
1040 to 1049	15	„
	963	
Not ascertained	6	
	969	

It is known that the specific gravity in healthy normal urine varies from 1015 to 1025, tending to be somewhat higher in children than adults, and it does not materially change by the presence of albumen. The specific gravity in normal urine is in direct proportion to the amount of urea present, and this was especially the case with the urines of high specific gravity above recorded. High specific gravity and abundant urine indicate diabetes mellitus, and low specific gravity with abundant urine are the symptoms of diabetes insipidus or of chronic renal disease.

(7) *Chemical constituents: Phosphates.*—These were present in excess in 240 cases out of the 969 examined—*i.e.* in nearly 25 *per cent.* of all the cases. Phosphates were not mostly present in alkaline or neutral but in acid urines. It is only too well known that phosphorus exists in the animal body in

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large quantities, either unoxidised and combined with albuminous compounds as in nervous substance, or in the form of phosphates in the body fluids and particularly also in the bones, and only in 68 cases (*i.e.* in 28 *per cent.* of the phosphatic cases) were the urines alkaline or neutral, a proportion less than that found in normal persons (33 *per cent.*). Most of the phosphorus present in the urine no doubt comes directly from the food, as is seen in the rise of the earthy phosphates after meals, but in my notes the presence of phosphates was not due to food, as no meal had been taken for some time before admission; but it is not improbable that some is derived from the oxidation within the body of the phosphorus of albuminoid tissues. Dr. Bence Jones formulated opinions that in acute inflammation of the brain there is an excessive amount of phosphorus in the urine, and that when the inflammation becomes chronic no phosphates can be shown to exist. It is significant in my cases that phosphates were more common in cases of melancholia than mania (*viz.*, 138 to 77 cases), although the proportion of cases of melancholia admitted into the asylum were only slightly more numerous than those of mania. It was also significant that the highest proportion occurred in cases of puerperal insanity, where we know that the mental symptoms may be very acute; the next highest proportion occurred in cases of epilepsy and in those of general paralysis, in which it has already been shown by competent observers that there is a considerable breaking-up of lecithin into glyco-phosphoric acid and cholin, or neurin. It is curious to relate that phosphates were almost absent from the urine in cases of alcoholic insanity and that they were in excess as constituents of the urine in cases of melancholia, puerperal insanity, and epilepsy.

(8) *Albumen.* — Of the important morbid constituents, possibly the first in point of seriousness is albumen, and it was present in a greater or less amount in 69 cases (7 *per cent.* of the whole). The ordinary examination of the urine for albumen merely shows the presence of a proteid, but does not indicate which of the proteids of the blood-plasma may be present. Recovery occurred in 20 cases of the 69 cases (29 *per cent.*), and death in 15 cases (22 *per cent.*). An analysis of the mental state showed 30 cases (43 *per cent.* of those with albumen) to be suffering from the melancholy form of insanity (*i.e.*, 3 *per cent.* of all the 969 cases

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recorded), 21 cases (30 *per cent.* of those with albumen) to be those of mania (*i.e.*, 2·1 *per cent.* of all the cases recorded), and 18 cases to be dementia (*i.e.*, 1·8 *per cent.* of the whole). The result in the 30 cases of melancholia was death in 6 cases (20 *per cent.*), recovery in 11 cases (37 *per cent.*). Of the 21 cases of mania, 9 recovered (43 *per cent.*) and 3 died (14 *per cent.*), and in the 18 cases of dementia 6 died (33 *per cent.*). Of the 15 cases which died and in whose urine albumen was present upon admission, chronic Bright's disease was the specific cause in 1, but renal cirrhosis and vascular degeneration were present in 7 cases (46 *per cent.* of the total deaths). Death in the others resulted from cerebral hæmorrhage or softening, from lung trouble (tuberculosis), bronchial states, and heart affections—probably consequent upon renal changes. The kidneys in the majority of cases which died presented the appearance of greater density than normal, the capsule was adherent and thickened, and it did not readily strip. The cortex was granular and diminished in thickness, measuring from 4 to 6 mm., and there were cysts present, with congestion, and in some cases fatty changes.

(9) *Sugar.*—As to sugar, it has been suggested that traces of glucose occur in normal urine, but sugar was present either as a slight trace in six cases, or in a greater amount in twenty-five cases—a proportion of 2·5 *per cent.* of all cases recorded. In twenty-six other cases the urine reduced Fehling's solution, but the presence of sugar was not confirmed. In no case was there diabetes mellitus, and the sugar disappeared eventually from the urine of all. These statistics do not agree with those of Dr. Bond (*Journal of Mental Science*, April, 1897) where his investigations showed sugar to be present in 5·35 *per cent.* In ten cases, or 32 *per cent.*, the mental state was mania. In eight cases (a proportion of 22 *per cent.*) sugar was associated with melancholia. Five cases were associated especially with the puerperal period of lactation, and the presence of lactose in the urine of these cases has been attributed to the recession of the milk (in asylums patients do not nurse their infants), and the carbohydrate constituents of milk appear in the urine in consequence. The mental state in one case was associated with alcohol, and the age was fifty-three. Three suffered from general paralysis, at an average age of thirty-nine years, and the fact of general paralysis being associated with a

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roughening of the ependyma of the fourth ventricle may suggest some association with physiological glycosuria. One was an epileptic, æt. 37, and two were senile cases. Nine cases (30 *per cent.*) out of the total recovered—including all the puerperal and lactation cases.

Those who died in whose urine sugar was found were six, but primary renal disease was not present in a single instance as a cause of death or as a contributory factor. The youngest age at which sugar was found was fourteen years, a case of adolescent melancholia with acute symptoms, which recovered, and the oldest was a case of senile insanity, æt. 82, and in whom the kidneys each weighed 128 grammes, the capsule stripped readily, the cortex measured 6 mm. to 8 mm., and the density was decreased.

It is accepted that drugs such as chloral, chloroform, and the salicylates may reduce Fehling's solution, but in this respect the previous medical treatment of these patients could not be ascertained. As already stated, lactose, which also reduces Fehling's, may be present in the urine of women who are nursing. Physiological conditions also, such as the presence of glycuronic acid, of uric acid in excess, and the presence of cretinin or hippuric acid, may also give the same reduction, but the fact that none of these cases died from diabetes mellitus is evidence that glycosuria is certainly not common in the insane.

(1) A paper prepared for the Annual Meeting in London, July, 1905.

Dr. KOCH, at the Annual Meeting, said that we could not judge anything at present of the mental condition from the mere analysis of urine. We might be able to draw some general conclusions as to the state of nutrition, especially in cases of under-nutrition, such as phthisis and wasting diseases, when we could tell if the patient were losing nitrogen. Urine analyses have recently been put upon a very accurate basis by Otto Folin, of the McLean Hospital for the Insane at Waverly, Massachusetts. The method requires, however, to be carried out by a trained chemist, and does not at present permit of any conclusions as to nervous metabolism, which is evidently of a very special kind. Indican (indoxyl potassium sulphate) in the urine indicates bacterial decomposition in the large intestine, and probably does not itself influence the mental state, although some of the bacterial toxins may lead to states of depression, frequently observed also in people not afflicted with mental disease. Phosphates are so largely derived from the food directly and may be metabolised by so many tissues of the body that the breaking up of nerve-tissues would not necessarily lead to an increase which could be detected by analysis with any degree of definiteness. Numerous attempts to correlate mental activity with phosphorus excretion have demonstrated this.

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